

A.I.D. EVALUATION HIGHLIGHTS NO. 19

A.I.D. SUPPORT OF ENERGY CONSERVATION IN PAKISTAN

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SUMMARY

U.S. Agency for International Development (A.I.D.) support for energy conservation in Pakistan has produced a model of environmental management that appears to work. A recent evaluation conducted by the Center for Development Information and Evaluation (CDIE) examines how A.I.D. has helped Pakistan to foster the adoption of energy conservation practices as part of the country's efforts to better manage its energy resources. The CDIE evaluation focuses on the energy conservation component of the USAID/Pakistan Energy Planning and Development (EP&D) Project.

Begun in 1986 as a pilot effort, the A.I.D.-supported energy conservation model (1) uses private sector profit incentives as an engine to sustain its activities and spread its impact; (2) employs an emerging partnership between the Government and private firms to accomplish objectives; (3) introduces basic, low-cost technologies with quick and visible pay-offs to attract and hold the interest of participants; and (4) produces environmental benefits that can be enjoyed by others beyond direct program beneficiaries.

At the time of CDIE's evaluation in October 1992, the Pakistan energy conservation program was completing its start-up or demonstration phase. The evaluation team found that changes were apparent in public and private attitudes about the program. In addition, new institutions were in place; new technologies and practices were introduced, tested, and adopted; and energy users, from industrial firms to domestic homemakers, were ready for more environmentally sound energy management.

With A.I.D. funding terminating in less than 1 year, the Pakistan Government was close to officially adopting and funding the energy conservation program that A.I.D. helped initiate. Pakistani program managers were also seeking other donor funding to continue to expand activities beyond the areas and beneficiaries reached with A.I.D. start-up support.

The CDIE evaluation concludes that the energy conservation activities set in motion with A.I.D. support cannot easily be reversed. With changes in political and economic policies toward the environment in Pakistan, greater and more sustainable impact is possible.

The central tenet of the evaluation is that the adoption of energy conservation practices and technologies responds to market incentives. The basic evaluation questions consist of the

following:

1. In fostering energy conservation practices, how important are A.I.D. development assistance strategies in

- Strengthening institutional capacity to plan, coordinate, and conduct energy conservation programs?
- Conducting education and outreach programs to raise awareness and transfer information?
- Developing or transferring information about energy conservation technologies?
- Reforming policies to remove market distortions and other disincentives?

2. Can a market for the supply and demand of energy conservation services and technologies

- Function on a sustainable basis after A.I.D. assistance is terminated?
- Expand its reach beyond those initial direct participants in A.I.D.-supported activities?
- Generate benefits to society that exceed the value of public—A.I.D. and host country—resources invested in making energy conservation programs work?

BACKGROUND

Pakistan is the fourth largest country in Asia. Its economy has grown at a rate of about 6 percent annually since the mid-1970s. Its industrial sector (20 percent of gross domestic product [GDP] in 1990) has grown at about 9 percent annually, bringing about significant structural change, especially in greater urban population density.

At some point during its rush to industrialize in the mid-1960s, Pakistan became a net energy importer. To meet increased energy demand, Pakistan invested heavily in hydroelectric power generation and in coal and oil exploration and extraction. These investments, however, have not kept pace with the country's demand for fuel and electric power. Moreover, coal, petroleum, and natural gas reserves are limited and the country's potential capacity for hydroelectric power generation has nearly been reached.

During the 1960s and early 1970s, the Pakistan Government used energy price controls and subsidies to stimulate the country's industrialization process. The global petroleum crisis in the mid-1970s, along with the drag of growing energy subsidies on the Government budget, forced Pakistan to reconsider its cheap energy policies. Assisted by A.I.D., the World Bank, and the International Monetary Fund, Pakistan began to restructure its energy sector, gradually allowing domestic fuel prices to rise to and remain pegged at international market levels and allowing private investment in energy production and distribution.

At the time of the CDIE evaluation, energy costs for most consumers were pegged to international prices. Natural gas for fertilizer production and electric power for residential use,

however, continue to be subsidized. Higher domestic prices have generated revenues for investment in expanding domestic power generation and energy production capacity, but have only modestly stanching the growth in energy demand. Pakistan today still depends on world markets to supply about one-third of its energy needs. Since 1968-1969, the growth of energy use has outstripped GDP growth by 2 percent annually, placing Pakistan on a clearly unsustainable path of economic development.

Growing energy demand from expanding industrialization has caused energy waste from inefficient practices and equipment. In its report to the United Nations Conference on Environment and Development (UNCED) in 1992, the Government of Pakistan summed up the country's energy problem:

"Pakistan is both energy deficient and energy profligate: deficient in the sense that its energy use per capita, at one-fourth of the world average, is one of the lowest in the world; and profligate because its consumption of energy in its relation to its GNP is one of the highest in the world—twice as high as [in] Brazil, Sri Lanka, and Germany, and almost four times as high as [in] Switzerland."

The contribution of energy conservation to reducing the country's energy shortfall has only recently received official attention in Pakistan. Fortunately, Pakistan has a significant potential for energy conservation. One leading energy expert estimates that Pakistan's potential energy savings are about equal in size to the country's total oil reserves, and maintains that a comprehensive national energy conservation effort could increase available energy supplies by 15 to 25 percent in a relatively short time. Pakistani leaders now recognize the importance of energy conservation in relation to Pakistan's energy needs and environmental problems. Until the mid-1980s, however, there was no national strategy or Government leadership for fostering energy conservation.

A.I.D.'S ASSISTANCE APPROACH

In 30 years of assisting Pakistan, A.I.D. has supported a range of development initiatives with environmental benefits. But A.I.D. programs with direct environmental and natural resources management objectives are relatively recent in Pakistan, which has only had an official National Conservation Strategy since 1991.

Pakistan's energy conservation program began in 1986 as a \$15.5 million component of the larger USAID/Pakistan Energy Planning and Development (EP&D) Project, which had started in 1983. The energy conservation program, the focus of the CDIE evaluation, primarily centered on creating and operating the National Energy Conservation Center, ENERCON, a public sector institution.

A.I.D. helped set up ENERCON to foster energy conservation in partnership with private engineering consulting firms contracted to conduct energy audits and provide energy conservation consulting services in the industrial, agricultural, transportation, and building construction sectors.

ENERCON also presents an array of training, education, outreach, and awareness programs for both the general public and specific energy users.

Since its establishment in 1986, ENERCON has been “making the market” for its energy conservation services in a national political and economic setting, where previously there was little concern about energy waste. With the help of A.I.D. resources, ENERCON developed both the demand and supply sides of the market for energy conservation services.

To stimulate demand, ENERCON, with guidance from a U.S. technical consulting firm, conducted free energy audits for interested manufacturing firms in order to identify visible, low-cost, quick pay-off measures to reduce energy bills. ENERCON also placed A.I.D.-funded computerized automobile emissions analysis units in gas stations and shared the cost of diagnostic services with station operators; operators then performed tune-ups for interested vehicle owners. Additionally, ENERCON led training seminars, distributed publications, and subsidized the sale of energy monitoring equipment to stimulate the adoption of energy saving practices among interested industrial firms, as well as owners or operators of private passenger cars and trucks, farm tractors and irrigation pumps, and office buildings. ENERCON also targeted special energy saving workshops for homemakers.

To develop the supply of energy conservation consulting and advisory services, A.I.D. funds have underwritten contracts between ENERCON and private Pakistani civil, industrial, and electrical engineering firms to conduct energy audits and to provide energy management consulting services. A.I.D. also has sought participation by automobile and farm equipment mechanics. The potential for follow-up and new design and consulting business from the ENERCON energy audit program has Pakistani engineering firms eager to participate in the program and conscientious in the energy audit work they conducted. The scope for private automobile and farm tractor tune-up business also attracted interest from gas station owners and farm machinery mechanics.

FINDINGS

Effects and Impact

Pakistan’s energy conservation program has had an impact on energy savings and on reducing pollutant emissions.

- *Industry.* Tune-ups of 600 boilers and 72 furnaces in 387 companies achieved an estimated average efficiency improvement of 6.3 percent for these firms. Eighty-four steam system surveys had an average efficiency improvement of 8 percent, and 40 electrical system surveys reduced average electric power demand by 5 percent in participating firms. ENERCON estimates that improved energy conservation led to an average 50 percent reduction in hydrocarbon and carbon dioxide emissions for the concerned firms. Estimated annual savings, after a 2-year pay-back period for

- participating firms in the ENERCON program is \$3.7 million annually.
- *Transportation.* More than 4,500 private automobile tune-ups reduced gasoline consumption for their owners by an average of 11 percent. ENERCON estimates carbon-monoxide and sulfur dioxide emissions dropped by 50 percent in tuned up vehicles. Annual fuel savings for participating vehicle owners, after an initial 1-year pay-back period, is about \$450,000.
 - *Agriculture.* One hundred twenty-four tubewells were audited and 43 retrofitted with average savings of 20 percent. A study of 21 tractors after tune-ups found an average of 18 percent savings in diesel fuel and a 50 percent cut in emissions during tillage operations.
 - *Buildings.* Forty-three preliminary (lighting, cooling, and insulation) energy surveys in government and private building structures also contributed to energy savings (see table). One hospital reported saving \$224,000 in 1989 by adopting energy conservation practices recommended by ENERCON.

Efficiency

Pakistan's energy conservation program shows strong gains in efficiency over the 10-year period of A.I.D. funding support. Initial per-unit costs of audits and training activities have dropped to levels that appear sustainable.

A.I.D.'s return rate on its \$15.5 million funding from the estimated \$3.7 million annual energy savings in the industrial sector alone is about 24 percent, well within the range of alternative power generation investment programs in Pakistan. ENERCON has also produced an additional estimated \$450,000 in annual energy savings through its initial computerized automobile diagnosis and tune-up program, as well as smaller annual energy savings from its activities in the agricultural and construction sectors. These energy savings, in addition to reducing pressures on fuel resources, have benefited the environment by reducing the emissions of pollutants.

Sustainability and Replicability

The evaluation examined five aspects of program sustainability and replicability: (1) public institutional capacity, (2) private sector capacity, (3) technology development and transfer capacity, (4) education and outreach capacity, and (5) policy reform.

Public Institutional Capacity. ENERCON is still a fledgling institution and its sustainability is uncertain. In response to evaluation questions about ENERCON's usefulness, participating firms applauded its partnership role, but cautioned against ENERCON becoming an environmental police officer. They argued that enforcement responsibilities were better left to the new Pakistan Environmental Protection Agency.

They gave ENERCON high marks for its energy saving technical literature and its conduct of training programs (see box). ENERCON also demonstrated staying power by securing

additional financing from other donors to continue and expand some of its programs after A.I.D. funding ends. At the time of CDIE's evaluation, ENERCON had not secured budget funding from the Pakistan Government to absorb A.I.D. project-funded staff. Moreover, the success of ENERCON's efforts to obtain special autonomous agency status is by no means certain. As a result, its ability to attract and hold qualified personnel has yet to be tested.

Private Sector Capacity. ENERCON expanded its scope beyond that of its own direct staff and resources by strengthening the technical capabilities of Pakistani contract engineering and manufacturing firms. This effort reinforced project sustainability and replicability. Since markets for energy conservation consulting services seem to be burgeoning, Pakistan's efforts to save energy may continue and spread regardless of the future of public agencies such as ENERCON.

Enhanced technical capacity in the private sector has been a positive by-product of the project, even though this was not a primary objective. When the U.S. consulting firm started its activities in Pakistan, it trained local engineers and professionals who worked as its subcontractors or consultants. Many of these trained engineers moved to other firms or started their own firms contracting with ENERCON. ENERCON continues to contract with local Pakistani engineering firms and has begun to invite tenders for conducting additional energy audits under other donor-funded programs.

The fact that private sector firms have started designing and monitoring energy saving systems and conducting surveys and audits on their own is further evidence of the sustainability and replicability of Pakistan's energy conservation program. ENERCON can help sustain this momentum by fostering information flows and encouraging demand among firms not yet reached by the program.

Technology Development and Transfer Capacity. ENERCON must find ways to remain current with advances in energy saving technology if it is to remain relevant to the needs of industrial energy users in Pakistan. It also must pursue more vigorous and systematic outreach programs (publications and seminars) for industrial firms as well as for consulting firms.

Education and Outreach Capacity. Greater awareness on the part of managerial and technical staff about energy conservation also increases program sustainability and replicability. To that end, ENERCON has expanded energy conservation awareness by (1) organizing about 120 workshops for more than 3,500 engineers, technicians, and managers; (2) producing practical manuals and publications for technical staff; and (3) conducting energy demonstration programs. By focusing on a few simple, highly visible measures for quick returns, ENERCON is creating an effective, if modest, demand for energy conservation consulting services.

Energy conservation awareness is not uniform, however. It appears highest in larger and foreign subsidiary firms and lowest in smaller local firms and larger public enterprises. Subsidiaries of foreign firms were the most progressive and encouraged more networking among energy efficient firms. These firms preferred a hands-on approach, such as site visits to ENERCON, more than publications and seminars.

Policy Reform. A.I.D. enjoyed a constructive dialogue with the Government of Pakistan throughout the implementation of its energy conservation project. This allowed for changes in rate structures and the introduction of penalties for electric power waste that certainly enhanced private interest in achieving savings through better energy use management.

Steps taken so far to change pricing, trade, and finance policies have enhanced the impact of the program and its sustainability. By continuing on an “environmentally friendly” course, Pakistan may be making the lowest cost/highest pay-off investment it can. With A.I.D. support ending, ENERCON must operate outside the privileged status of the EP&D project. It will need to work toward easing rules and regulations that restrict access to energy conservation information and equipment from abroad and energy finance at home.

LESSONS LEARNED

A favorable economic and political climate is critical to the successful acceptance and performance of an energy conservation program. After more than a decade of rising energy import bills and increased disruption of industrial production from power shortages, Pakistan’s political leadership finally looked to energy conservation, along with price policy reform, as an important strategy for bringing energy supply and demand into better balance. Private industrial firms particularly were feeling the effects on their balance sheets. Consequently, there was a greater receptivity to the plans and programs of ENERCON than is usually the case with development projects.

Energy conservation sells best when participants are given access to low-cost technologies with prompt pay-back benefits. At the outset, ENERCON began conducting comprehensive Total Energy Management audits and recommendations. It soon realized that instead of trying to change the whole system it could achieve significant economies in fuel consumption with simple tune-ups of boilers and furnaces. In interviews with the CDIE evaluation team, most firms mentioned that they were initially persuaded by the promise of visible and immediate changes in their energy bills. The energy conservation formula that seemed to work best consisted of the following:

- ENERCON-sponsored energy audits or surveys that could be completed within 1 or 2 days without disrupting the operations of the firm
- Financial savings to cooperating firms that would show up quickly in lower energy fuel bills
- Investments in energy saving equipment or practices that could be recovered within 3 to 24 months

Local private engineering expertise is critical for spreading and sustaining the provision of energy conservation services. Pakistan has a reservoir of trained engineers who understand energy conservation engineering principles. Pakistani engineers have good training in civil, electrical, and mechanical engineering fields. What they lack is practical energy management knowledge and experience. Nevertheless, with a little training and exposure to conservation

practices, these engineers have acquired the necessary expertise to become energy conservation consultants. Dozens of private Pakistani civil, electrical, and mechanical engineering consulting firms are in a position to respond to the emerging market opportunities for energy conservation advisory and design services. Most of them are relatively small, managed by two or three professionals with assistance from a number of associates. Pakistan's recent move toward privatization has stimulated the growth of such firms.

Flexible project design permits program managers to respond effectively to new conditions and opportunities. At the outset, the Pakistan energy conservation program focused on broad energy surveys that took time, staff, and resources and produced ambitious recommendations that were likely to end up with little chance of implementation. Also, the A.I.D. EP&D project initially prohibited the local engineering firms it contracted from pursuing consulting opportunities generated by the audit recommendations. It later revised its program so that "targeted" energy audits could identify quick pay-off changes, and it encouraged energy audit firms to engage in follow-up consulting and design efforts for implementation of recommendations. Project adjustments such as these were critical to achieving the program's energy conservation targets.

OUTSTANDING ISSUES

The experience of Pakistan's energy conservation program raises three issues that merit careful examination both in the context of Pakistan itself and for other countries. The evaluation recommends that these issues be the basis of a reexamination of the Pakistan energy conservation program after 5 years.

The Role of Program Subsidies

To support ENERCON's energy conservation program, A.I.D. approved use of a share of EP&D project funds (1) to subsidize energy audit contracts and consulting work for participating industrial firms; (2) to pay a share of the costs of computerized automobile engine diagnoses for individual vehicle owners; (3) to underwrite the distribution of training and information sources free or at nominal cost to participating private firms and individuals; and (4) to off set a share of the sale prices of energy monitoring equipment. These subsidies, it was argued, were necessary to break down the initial resistance and skepticism about ENERCON's motives among the industrial firms, automobile owners, and other energy consumers. ENERCON believed that some subsidies were warranted to compensate private firms and individuals for a share of the costs incurred in reducing pollutants.

One danger associated with subsidies is their potential for creating market distortions that undermine the very conditions and practices they were originally used to promote. Therefore, once subsidies have "made the market," that is, produced the desired demand and supply response as in the case of energy audits and automobile engine diagnoses in Pakistan, energy conservation programs may do well to terminate subsidies completely or partially.

A second concern over the use of subsidies is the efficiency and equity with which they are administered. Even during the initial start-up phase of the ENERCON program in Pakistan, some audits and other services were performed at subsidized rates for firms or individuals quite able to pay the full costs of the services (e.g., large subsidiaries of multinational firms and private vehicle owners).

The Role of Nonproject Assistance

In addition to the activities of ENERCON, several other factors have contributed to the adoption of energy conservation practices in Pakistan. For example, price policy, market deregulation, and structural adjustment measures undertaken by the Government of Pakistan have all played an important part. These measures were often included in the Government's agreement with donors for nonproject assistance for economic reforms. In addition, donors also provided nontechnical assistance in the energy sector.

At issue is whether energy conservation can be fostered solely through nonproject assistance, saving the resources, human and other, that have gone into building institutions and programs aimed at teaching more efficient energy use to manufacturing, transport, and construction firms, as well as farmers, homemakers, vehicle owners, and others. The extent to which project and nonproject assistance are either complementary or duplicative in their effects merits close examination in the course of the evaluation of A.I.D. energy conservation programs. The outcome will help define the best approaches to maximizing the return on development assistance for energy conservation.

The Involvement of Nongovernmental Organizations

ENERCON may not have been the only—or the best—institutional mode through which the energy conservation program operated in Pakistan. In Pakistan, the nongovernmental world comprises a range of private professional organizations and associations to which energy-using industries and individual engineering firms and consultants belong.

Had the A.I.D.-funded program chosen to do so, it could have worked directly with the local associations of professional civil, electrical, and mechanical engineers and consultants, and with a broad range of local chambers of commerce and industry to which many of the firms reached by ENERCON belonged. Little attention seems to have been given to these networks of professionals and industries during EP&D project design and program implementation.

With energy incentives already in place as a result of rising fuel and electricity pricing, engineering consultant and industrial firms might have been equally responsive to assistance provided to and through their own professional associations as through a single Pakistani Government agency. At the very least, future energy program activities ought to explore the potential for using professional associations and networks as extensions of ENERCON programs. Energy conservation programs planned in other countries should consider an active role for professional, industrial, and commercial organizations.

This Evaluation Highlights summarizes the findings from the report Assessment of A.I.D. Environmental Programs, Energy Conservation in Pakistan (forthcoming), A.I.D. Technical Report Series. Technical Reports can be ordered from the DISC, 1611 North Kent Street, Suite 200, Arlington, VA 22209-2111, telephone (703) 351-4006; fax (703) 351-4039.